INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.56

(05/2003)

SERIES L: CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Installation of optical fibre cables along railways

ITU-T Recommendation L.56

ITU-T Recommendation L.56

Installation of optical fibre cables along railways

Summary

This Recommendation describes methods to install optical fibre cables along railways. This Recommendation summarizes all the answers to the questionnaire prepared and circulated previously.

Source

ITU-T Recommendation L.56 was approved by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure on 14 May 2003.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g. interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation L.56

Installation of optical fibre cables along railways

1 Introduction

The current situation of the telecommunication market, and wide use of optical fibres as a transmission media, have contributed to the fact that some companies, apart from the incumbent telecommunication providers, like railway companies, have become interested in laying optical cables along their own infrastructures. These installations could be used for internal communications of the railway companies, or be offered to other customers for public telephony.

On the other hand, telecommunication companies could use the railway facilities to provide telecommunication services to their clients.

Types of cable and infrastructures used in these installations can be very different. This Recommendation describes several possibilities, depending on the installation environment.

All the information found on this Recommendation has been summarized from the replies from several countries to a questionnaire prepared by ITU-T Study Group 6 participants.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[1] ITU-T Recommendation L.10 (2002), *Optical fibre cables for duct and tunnel application*.

[2] ITU-T Recommendation L.12 (2000), *Optical fibre joints*.

[3] ITU-T Recommendation L.26 (2002), *Optical fibre cables for aerial application*.

[4] ITU-T Recommendation L.34 (1998), *Installation of Optical Fibre Ground Wire (OPGW) cable*.

[5] ITU-T Recommendation L.35 (1998), *Installation of optical fibre cables in the access network*.

[6] ITU-T Recommendation L.13 (2003), *Performance requirements for passive optical nodes: sealed closures for outdoor environments*.

[7] ITU-T Recommendation K.33 (1996), *Limits for people safety related to coupling into telecommunications system from a.c. electric power and a.c. electrified railway installations in fault conditions*.

[8] ITU-T Recommendation K.53 (2000), *Values of induced voltages on telecommunication installations to establish telecom and a.c. power and railway operators responsibilities*.

3 Cables

In this case, transmission media is an optical fibre. The cable core may have different configurations: tight tube, loose fibre in tube, loose fibre in groove and ribbon. Usually, the most common configuration is loose fibre in tube.

The type of sheath and armouring of the cables depends on several factors: design of the cable, method of installation and kinds of infrastructures to be used. Generally, totally dielectric cables or armoured cables with corrugates steel tapes, can be used in direct burying and in ducts installations. In aerial applications, totally dielectric cables are recommended. Another alternative to these aerial cables are Optical Fibre Ground Wire (OPGW) cables. In this case, caution must be taken in order to avoid problems in the signalling system or traction line of the railway.

4 Types of infrastructures

Several types of infrastructures can be used in the installations: in ducts, directly buried or aerial installations. In case of metallic armouring, periodic ground feed-through should be implemented. ITU-T Recs K.33 and K.53 give guidance of this issue.

The choice of one among various types of infrastructures depends on the environment (urban area or rural area). Existing infrastructures should be used wherever possible. A study of environmental impact, regulations in each region and economic factors should be conducted (carried out) in order to decide on the type of installation.

In urban areas, ITU-T Rec. L.35, "*Installation of optical fibre cables in the access network*", should be taken into account.

4.1 Duct installation

In duct installations, different cable designs can be used: totally dielectric cable or metallic armoured cable.

Installation in ducts of the Railway Company is common, but installation in ducts of a local telecommunication provider is also possible.

Depending on the cable design, they should be installed in the duct by any of the traditional or blowing methods. In any case, all the precautions about handling the cable, splice boxes, storage of excess length of cable and personal security should be taken into account.

In the case where the cable is laid into a concrete trench that is then covered with plates, armoured cable is recommended.

4.2 Direct buried cable installation

In direct buried cable installation, it is recommended that a cable designed to protect optical fibres from external shocks, attacks from rodents, or any other harsh environmental conditions, should be chosen. Armouring with corrugated steel tape or any other type should be considered.

Any of the traditional methods of installation should be used, depending on the cable design.

4.3 Aerial installation

In aerial installations, the use of totally dielectric cables, is recommended. In some cases, armouring the cable against hunters, squirrels or birds, might be necessary depending on the environmental conditions.

An alternative to the use of totally dielectric cables, could be the use of Optical Fibre Ground Wire (OPGW) cables. When using this type of cable, care must be taken to avoid any trouble with the signalling system or traction line. ITU-T Rec. L.34, "*Installation of Optical Fibre Ground Wire (OPGW) cable*" should be taken into account.

Usually, poles of the railways power supply line shall be used for suspending or anchoring the cable. Another possibility is to use additional line poles, which could belong to the telecommunication provider.

Poles material for railways power supply can be concrete or iron. Additional line poles should be made of wood, concrete, steel, fibre or plastic depending on the costs and environmental impact study.

4.3.1 Cable installation along the railways' poles line

When using the railways' power supply poles line in the installation of the optical cable, cable can be suspended from field side or from railway side.

Minimum vertical distance from ground level (when cable is installed on field side) or from the top of the rail (when cable is installed on railway side) to aerial cable shall be more than 5 metres and less or equal to 10 metres. Horizontal separation from the live conductor will depend upon the design of the poles line, taking into account the safety requirements for operatives.

Span length (distance between poles) depends on the laying characteristics and the cable design.

A nominal cable sag not exceeding 3% is recommended.

Cable should be suspended on all the poles in the appropriate way, depending on the cable design and the laying characteristic. A common way to do it is using clamps or pulleys.

At special positions (splice points, end of the route, every given number of poles, etc.), the cable should be fixed to the pole.

4.4 Particular cases

Cable installation through singular points, like tunnels or bridges, requires some additional protection or special precautions (e.g., fire retardant sheaths).

In case the cable is installed in tunnels, it shall be bound in an appropriate way: fixing it on a support, on the wall with staples or using ducts.

In case the cable is installed on bridges, it is recommended to use ducts.

4.5 Splice points

4.5.1 Splice location

When splices are installed in manholes, the suitability of making the splices inside or outside the manhole should be considered, as well as the characteristics of the splice box, cable, manhole and personal security. In any case, a length of cable should be stored in the manhole in order to allow the correct fulfilment of the splice. Usually, a minimum length of 5 metres from each end is recommended when splicing takes place inside the manhole. When splicing takes place outside the manhole, a minimum length of 10 metres is recommended. Anyway, stored cable length will depend on the characteristics and dimensions of the manhole and the splice box.

In aerial installations, splicing can take place on the top of the pole or on the ground. As in the previous case, a length of cable should be stored in the pole for cable splicing purposes. Stored cable length will depend on the position of the splice box and the place where the splice is carried out. The suitability of making the splice at the top of the pole or on the ground should be considered, according to personal security and the characteristics of the cable and the splice box.

In any case, cable should be wound and fastened in such a way that the minimum bending radii indicated by the manufacturer is respected.

4.5.2 Fixing the splice box

Inside the manhole, the splice box should be fixed directly on the wall or using an appropriate support, depending on the box design.

In aerial installations, it is recommended fixing the splice box on the pole, avoiding fixing it in line with the cable.

It is recommended to avoid the installation of the splice box inside tunnels or bridges. If it is not possible to avoid its installation inside a tunnel, the splice box should be fixed on a support or directly on the wall.

4.5.3 Closures properties

Splice boxes should be sealed according to ITU-T Rec. L.13.

Depending on the application they could be pressurised, but this is not necessary in most cases.

Appendix I

Ukrainian experience

I.1 Introduction

This appendix represents the experience of Ukraine in an optical fibre cable line installed along a railway line. The text contains methods of fastening of optical cables on poles, fixing of optical cable by clamp, and joint closures arrangement on poles used in Ukraine.

I.2 Suspension of cables on poles

The suspension of optical fibre cables on poles of a railway contact network on Ukraine territory is achieved by the use of full dielectric self-supports cables.

The optical fibre cables are usually suspended on existing railway poles of a contact network (Figure I.1), less often on poles of aerial communication lines.

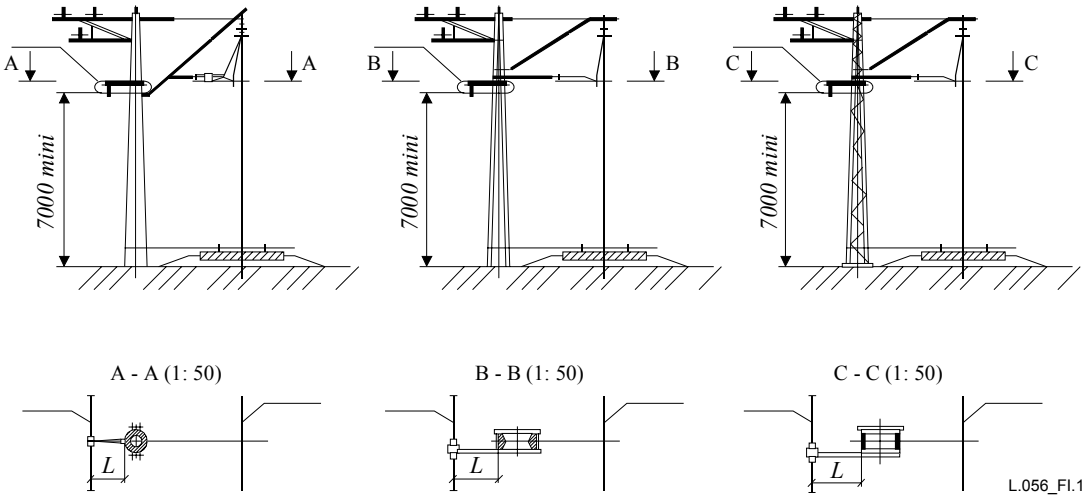


Figure I.1/L.56 – Allocation circuit of optical fibre cables on poles of a contact network

The suspension is always carried out by the field party.

For suspension of optical fibre cables on poles, the method of a relocatable drum is used. In exceptional cases, the method of a stationary drum is used.

The cable is fastened on poles that are at the end of or at angles of the cable path by the means of wire captures (Figure I.2) and on intermediate poles with the help of modular brackets (Figure I.3).

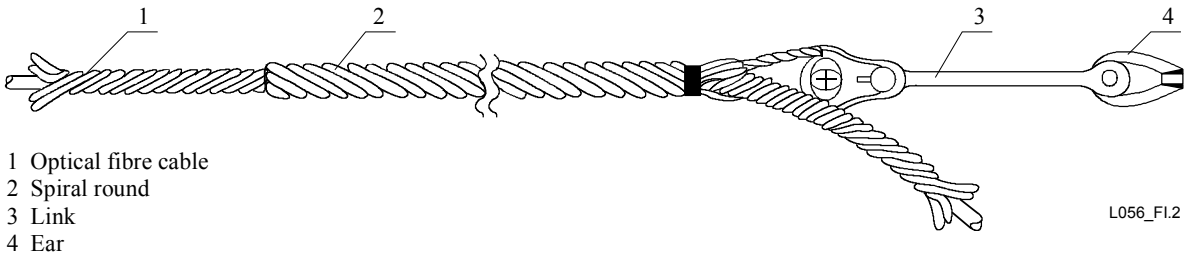


Figure I.2/L.56 – Wire capture

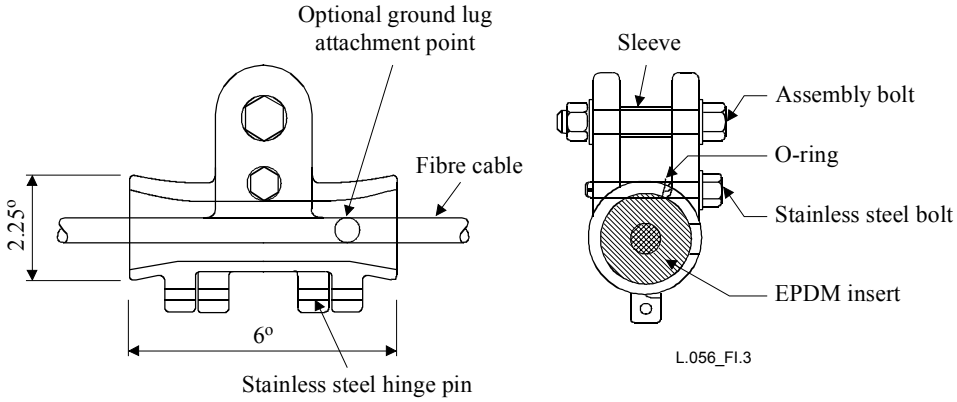


Figure I.3/L.56 – Modular bracket

Sag of optical fibre cable between poles (points of fastening) does not exceed 1%.

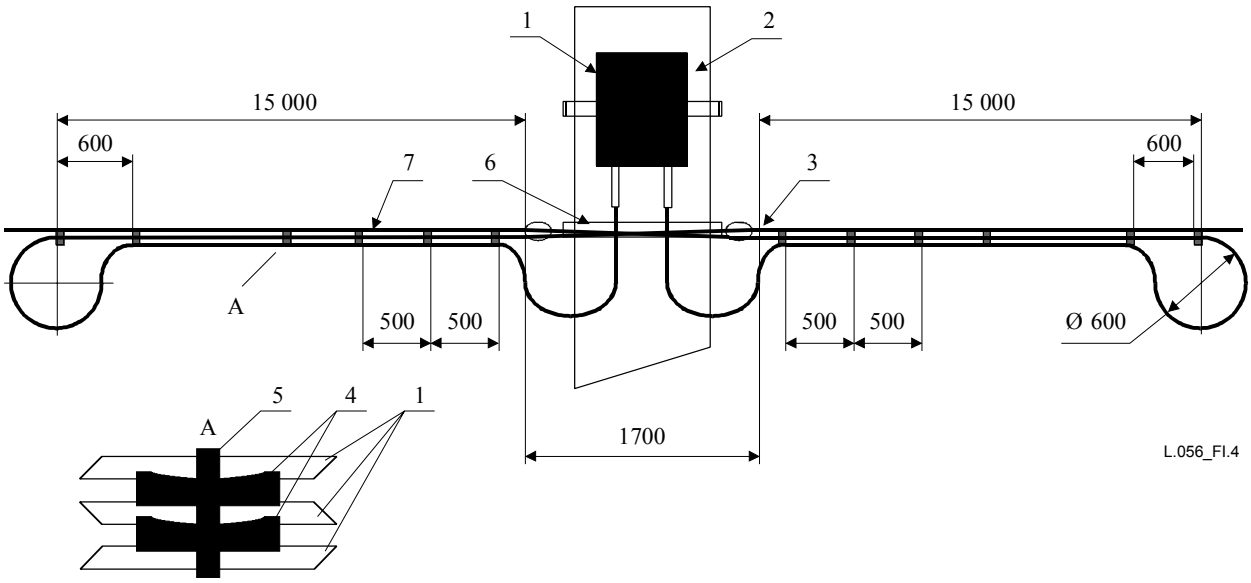
Distance from the bottom point of cable suspended on poles of a contact network, up to a level corresponding to a line joining the base of poles at maximal sag, should not be less than 5 m. When an optical fibre line crosses the railway line, the distance from cable to the top of the rail at maximal sag should not be less than 7 m.

I.3 Installation of optical fibre cables suspended on poles

In order to provide for installation and control tests at the beginning and at the end of each construction length, additional length of cable shall be provided. This additional length shall be sufficient to allow for installation and re-installation, using connecting closures. Besides, it is sometimes necessary to provide an additional cable length for future possible installation works on the ground.

Closures and additional cable length are installed on poles as shown in Figure I.4.

The closures provide stable electrical and mechanical characteristics for the optical fibre cable during installation and operational life.



1 Joint closure
2 Pole of a contact network
3 Kink
4 Packing between the cables
5 Plastic strap
6 Yoke
7 Optical fibre cables

Figure I.4/L.56 – Allocation of closure and cable stock on a pole

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	**Construction, installation and protection of cables and other elements of outside plant**
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks and open system communications
Series Y	Global information infrastructure and Internet protocol aspects
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2003